UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

To: Jim Downing, Regulatory Action Leader
Biopesticides and Pollution Prevention Division, 7511C

From: Robyn Rose, Entomologist
Biopesticides and Pollution Prevention Division, 7511C

Peer Review: Russell Jones, Ph.D., Biologist
Biopesticides and Pollution Prevention Division, 7511C

Product: REPEL® NATURAL Insect Repellent Non-Aerosol Pump; EPA Reg. Nos. 305-LA, 305-LT, and 305-LI; Barcode No. D264483; Case No. 062647; Submission No. S577539.

Formulation: REPEL® NATURAL Insect Repellent Non-Aerosol Pump contains 40% Extract of Lemon Eucalyptus and 60% other ingredients. The Extract of Lemon Eucalyptus contains approximately 65% *p*-menthane-3,8-diol, 66% *cis* and 34% *trans* isomers.

Action/Study Type: Review of efficacy (product performance) data in support of registration; MRID No. 450291-01

Public Health Pests: mosquitoes, sandflies, ticks, midges, stable flies, and many other biting insects

Label Claims: "The active ingredient in Repel Natural has been used for years in Europe to protect people from mosquitoes and many other biting insects. Repel Natural repels mosquitoes for up to one hour. Repels mosquitoes, sandflies, ticks, midges, stable flies." Under Directions for Use it states: "Apply to exposed skin and clothing to protect from mosquitoes and biting insects. Reapply every hour or as needed."

Classification: Supplemental. To upgrade to acceptable, an additional field test on a *non-Aedes* mosquito species and an additional deer tick test should be conducted after the final draft of OPPTS 810.3700 Insect repellents for human skin and outdoor premises is published..

Conclusions:

1. Submitted studies (MRID Nos. **450291-01**, 450615-02, and 446241-05) demonstrate efficacy for mosquitoes and deer ticks, but not for sandflies, midges, and stable flies. Therefore, only deer ticks (not ticks) and mosquitoes should be listed on the label. Both products demonstrated up to six hours of protection for mosquitoes. Repel Natural Lotion demonstrated six hours of protection against deer ticks; Repel Natural Spray demonstrated four hours of protection against deer ticks.

2. Studies submitted in MRID No. 446241-05 do not demonstrate efficacy of the Repel Natural products. To bridge data, tests would have to be conducted on chemically similar products. Tests in MRID No. 446241-05 were conducted: (I) with50% a.i. rather than 30% and 40% a.i.; (ii) with p, menthane 3,8-diol rather than Lemon of Eucalyptus; and (iii) the test formulations did not include inerts. Acceptable efficacy tests should be conducted with Repel Natural non-aerosol pump and Repel Natural lotion on sandflies, midges, and stable flies for these vectors to be listed on the label.

3. The field test - Mosquito repellent efficacy of Natural Insect Repellent Lotion and Pump (MRID NO. **450615-02**) demonstrated that these products will repel mosquitoes for up to eight hours. The Agency is currently recommending two field tests be conducted in environmentally distinct habitats on two different mosquito species. Although there is only one field test submitted to the Agency at this time, another field test may be required when the draft insect repellent product performance protocols being developed at EPA are finalized.

4. The study found in MRID No. 450291-01 was not conducted according to GLP. According to 40 CFR Part 160.17 "EPA may refuse to consider reliable for purposes of supporting an application for a research or marketing permit any data from a study which was not conducted in accordance with this part." Non-GLP practices are addressed in 40 CFR Part 160.12(b) which states that "[a] statement describing in detail all differences between the practices used in the study and those required by this part." There was no statement included with this study describing what aspects of GLP were not met and why. Generally, for a study to be considered acceptable, it must be conducted according to GLP or a non-compliance statement describing what aspects of GLP were not met should be submitted to the Agency. However, at this time, the Agency is not recommending the submission of laboratory cage tests to determine efficacy of repellents. The Agency will determine if laboratory tests are necessary pending the publication of the SAP Subpanel report on efficacy testing of insect repellents applied to human skin.

5. The deer tick efficacy test (MRID No. **450615-01**) demonstrated that the Natural Insect Repellent Spray will repel ticks for four hours and the Lotion will repel ticks for six hours. Although this test is currently acceptable, an additional tick test should be conducted when the final insect repellent product performance guidelines are published.

Background:
In support of their application to register Natural Insect Repellent Lotion and Natural Insect Repellent Pump, Wisconsin Pharmacal Inc. submitted efficacy data to the Agency. These data were reviewed by the Agency in a memorandum dated February 9, 1999. This review concluded that

> Most of the efficacy studies are inappropriate for the product. Almost all of them tested similar products at a concentration approximately 25% higher in the active ingredient. Many of the studies were not well documented and the material not well presented. One *Aedes aegypti* cage-test mosquito study performed for Wisconsin Pharmacal Company is considered acceptable as it tested all the end-use products submitted for registration. In addition, however, BPB would like additional mosquito studies done on two other species, an *Anopheles* and a *Culex* species. In addition to te cage test, a minimum of one field test on mosquitoes should be conducted.
>
> The tick tested was the sheep tick *Ixodes ricinis*, a carrier of Lyme disease in other countries, but not considered one of the main carriers of the disease in this country. The deer tick (*Ixodes scapularis*) is the primary carrier in the US, and it is not known if the deer tick will respond in the same way to this product. The method of testing is also considered inappropriate, as it did not use humans.
>
> If stable flies, midges and sand flies are to be kept on the label as pests the product will repel, field tests on all species are required plus a lab test on the stable fly.

On June 9, 1999, the Agency sent a pre-acceptance letter to Wisconsin Pharmacal Company. This letter informed Wisconsin Pharmacal that their submission for registration would be acceptable provided that additional efficacy data to support the three end use products which consist of:

- additional mosquito cage studies done on two other species, an *Anopheles* and a *Culex* species;
- a minimum of one additional field test on mosquitoes should be conducted;
- a tick test for the deer tick (*Ixodes scapularis*), the primary carrier of Lyme disease in the US; and
- if stable flies, midges and sand flies are to be kept on the label, a lab test for stable flies and field test(s) for midges and sand flies must be submitted;

DATA EVALUATION REPORT

STUDY TYPE:	Laboratory cage test - Mosquito repellent efficacy of 40% Oil of Lemon Eucalyptus
MRID NO.:	450291-01
PROJECT ID:	WP 99 8-8
SPONSOR:	WPC BRANDS, INC.
TEST MATERIAL:	Oil of Lemon Eucalyptus 40% Pump Spray Lot 71399 (EPA Reg. Nos. 305-LA, 305-LT, and 305-LI)
TESTING FACILITY:	Medical and Veterinary Entomology Research Laboratory, Agricultural Research Service, USDA, Gainesville, FL.
AUTHOR:	Dr. Donald R. Barnard
STUDY COMPLETED:	January 19, 2000

Study Summary

Title: Laboratory Testing for Insect Repellents Efficacy - Oil of Lemon Eucalyptus

Objective: "[T]o assess the mosquito repellent efficacy of 40% Oil of Lemon Eucalyptus against three genera of mosquitoes (Aedes, Anopheles, and Culex) in laboratory cage tests."

Methods:
A 1 mL formulation of 40% Oil of Lemon Eucalyptus was compared to a 1 mL 25% DEET/ethanol formulation as a mosquito repellent. Each formulation was applied to one forearm (1 in above wrist to 1 in below elbow) of each test subject; this is equivalent to approximately 1 mL/650 cm^2. For each species tested, one hundred to 200 adult female mosquitoes (6 - 9 days old) were starved for twelve hours prior to being released in a 14×14×14 cage with a sleeved opening. Treated arms were inserted into the cage and exposed to mosquitoes for three minutes at the beginning of the test and hourly thereafter. Each formulation was tested on two or three volunteers. Duration of repellency was based upon mean time to first confirmed bite (FCB) and significant differences were calculated using a student's "t" test.

Results:
Duration of Repellency for 40% Oil of Eucalyptus and 25% DEET based on time to FCB

Test Species	Oil of Lemon Eucalyptus	DEET
Aedes aegypti	300 min (5 hrs)	390 min (6.5 hrs)
Aedes albopictus	430 min (7.2 hrs)	440 min (7.3 hrs)
Anopheles quadrimaculatus	45 min (.75 hrs)	45 min (.75 hrs)
Anopheles albimanus	<30 min (.5 hrs)	<30 min (.5 hrs)

Culex nigripalpus	500 min (8.3 hrs)	490 min (8.2 hrs)

Conclusions:
This cage test demonstrated that 40% Oil of Lemon Eucalyptus will repel mosquitoes from less than 30 minutes to approximately eight hours. Repellency of Oil of Lemon Eucalyptus was comparable to 25% DEET. This study did not report what ingredients were included in the test formulation nor did it include a negative control to verify biting pressure. It can be inferred that the test was conducted with Repel Natural Pump Spray. The test should have been conducted on the end-use formulation and included a negative control. Although this test was not conducted according to GLP, did not utilize enough test subjects, and did not clarify if it was conducted with the end-use product, the study does not need to be repeated. The FIFRA Science Advisory Panel that convened on April 7, 2000 indicated that laboratory tests would not be necessary to verify efficacy of repellents.

DATA EVALUATION REPORT

STUDY TYPE:	Field test - Mosquito repellent efficacy of Natural Insect Repellent Lotion and Pump
MRID NO.:	450615-02
PROJECT ID:	WP 99 10 03
SPONSOR:	WPC BRANDS, INC.
TEST MATERIAL:	Natural Insect Repellent Lotion (30% Oil of Lemon Eucalyptus) (PF #7030B, Lot #092999) and Natural Insect Repellent Pump (Spray; 40% Oil of Lemon Eucalyptus) (ID #0625982, Lot #0927991). EPA Reg. Nos. 305-LA, 305-LT, and 305-LI
TESTING FACILITY:	Carroll-Loye Biological Research, 711 Oak Ave, Davis, CA 95616
AUTHOR:	Dr. Scott P. Carroll
STUDY COMPLETED:	October 21, 1999

Study Summary

Title: Field Test - Mosquito Repellent Efficacy/Duration of Wisconsin Pharmacal Company Formulae: 1) Natural Insect Repellent Lotion (PF #7030B, Lot #092999) and Natural Insect Repellent Pump (Spray) (ID #0625982, Lot #0927991)

Objective: "This test had two independent objectives. The primary objective was to assess the mosquito repellent efficacy of the Wisconsin Pharmacal Lotion and Spray formulations in a field setting representative of that under which they would be used by consumers. The second was to measure any impact of dosage by applying each formula at 1X and 1.5X rates. "

Methods:
Natural Insect Repellent Lotion (30% Oil of Lemon Eucalyptus) and Natural Repellent Nonaerosol Spray (40% Oil of Lemon Eucalyptus) efficacy was evaluated. Performance of the test materials were compared to a negative (untreated) control and a positive control (Deep Woods Off Lotion containing 20% DEET). Tests were conducted in Butte County California on October 2, 1999 from 10 am to 4:30 pm. Treatments were applied evenly to the forearms and lower legs of adult males and females at rates of 1.0 g and 1.5 g/600 cm^2. Ten test subjects (7 males & 3 females) were used to test the lotion formulation and ten applied the spray (6 male & 4 female) to one forearm and one lower leg. One gram/600 cm^2 of Deep Woods Off was used as a positive control on one male and one female. Negative controls, used to determine biting pressure, included one untreated forearm and one untreated lower leg. Most of the test subjects exposed the treated or untreated test area for six hours; two test subjects discontinued exposure after five hours. Bites were observed and recorded in a series of five minute periods.

Data was analyzed with SAS Version 3. Mean biting rates were calculated as 100(1 - Mean of

Treatment/Mean of Untreated Control). Complete protection time (CPT) was recorded as the time to first confirmed bite (FCB).

Results:
See Appendix I (Tables 5, 6, 7, & 8) for results.

Mean temperature was 29.2°C; 27.9 avg. relative humidity; 0.9 avg. wind speed; 1196 avg. light intensity; and a clear sky. Biting mosquitoes collected from untreated control subjects and identified by Carroll-Loye biological included: *Aedes malnimon*, *Aedes vexans*, and *Aedes increpitus*. Mean biting rates on untreated control subjects were 7.29±3.96 bites on the forearm and 14.07±10.55 bites on the lower leg per five minute exposure period.

Conclusions:
This study was acceptable. Biting pressure at the test site was adequate to verify that Natural Insect Repellent Lotion PF (30% active ingredient) and Natural Insect Repellent Pump (Spray, 40% active ingredient) repelled *Aedes* mosquitoes for six hours. Although two test subjects discontinued exposure after five hours, enough test subjects remained to verify up to six hours of repellency. These products did not fail during the duration of the test. The repellency may last longer than six hours but can not be claimed since the test was terminated at this point.

DATA EVALUATION REPORT

STUDY TYPE:	Laboratory Test - 'Deer Tick' Repellent Efficacy/Duration (using nymphal *Ixodes pacificus*, the Western Black-legged Tick) of Wisconsin Pharmacal Company Formulae: 1) Natural Insect Repellent Lotion PF (#70309B, Lot #092999) 2) Natural Insect Repellent Pump (Spray)(ID #0625982, Lot #0927991).
MRID NO.:	450615-01
PROJECT ID:	WP 99 10 16
SPONSOR:	WPC BRANDS, INC.
TEST MATERIAL:	Natural Insect Repellent Lotion (30% Oil of Lemon Eucalyptus) (PF #7030B, Lot #092999) and Natural Insect Repellent Pump (Spray; 40% Oil of Lemon Eucalyptus) (ID #0625982, Lot #0927991). EPA Reg. Nos. 305-LA, 305-LT, and 305-LI.
TESTING FACILITY:	Carroll-Loye Biological Research, 711 Oak Ave, Davis, CA 95616
AUTHOR:	Dr. Scott P. Carroll
STUDY COMPLETED:	November 10, 1999

Study Summary

Title: Laboratory Test - 'Deer Tick' Repellent Efficacy/Duration (using nymphal *Ixodes pacificus*, the Western Black-legged Tick) of Wisconsin Pharmacal Company Formulae: 1) Natural Insect Repellent Lotion (PF #7030B, Lot #092999); 2) Natural Insect Repellent Pump (Spray) (ID #0625982, Lot #0927991).

Objective: "The fundamental objective was to compare the repellency to nymphal Western Black-legged Ticks, *Ixodes pacificus*, of Wisconsin Pharmacal Lotion and Spray formulations with reference to an untreated control.

Methods:
The efficacy of Natural Insect Repellent Lotion (30% active ingredient) and Pump Spray (40% active ingredient) were compared to an untreated control and a positive control ('Deep woods Off Lotion; approximately 20% DEET) in the Arthropod Behavior Laboratory at Carroll-Loye Biologically Research. Nymphal deer ticks were evaluated because this is the stage capable of vectoring lyme disease. There were eleven test subjects for the Natural Insect Repellent Lotion, eleven subjects for the Natural Insect Repellent Pump. Two of the 22 treated test subjects were also treated with DEET for comparison. The other 20 test subjects also served as untreated controls. Test materials and positive controls were applied to subjects forearms at a rate of 1 g/600 cm^2.

Ticks were placed on the test subjects wrist approximately 2 -3 cm below the border of the test

material. Ticks were gently guided in the direction of the test material and allowed to remain on the wrist for 3 - 5 minutes. Each tick was exposed to the test material once and considered "crossing" if it moved at least 2 cm from the margin of the test material toward the elbow. If the tick crossed onto the test material it was not considered to be repelled. Twenty five sequential samples were collected every 15 minutes for six hours. Mean percent repellency was calculated as well as the mean time to first confirmed crossing (FCC; a crossing followed by another within 30 minutes; the second crossing confirms the first).

Results and Conclusions:
Ticks that appeared repelled by the test material changed direction or moved around the wrist upon approach. Ticks that crossed onto the test material often remained there. Forearms that were not treated did not demonstrate repellency; whereas, treated forearms demonstrated 95% reduction in bites for three hours. Mean protection time based upon FCC was 5 hours and 40 minutes for the Lotion and 5 hours and 27 minutes for the spray.

Percent repellency (number of repulsions divided by number of trials) at hourly intervals during the six hour study (cumulative data, subjects pooled).

Treatment	# subjects	1 hr	2 hrs	3hrs	4 hrs	5 hrs	6 hrs
Lotion (30% a.i)	11	98.1	97.9	97.1	96.1	95.5	95.5
Spray (40% a.i.)	11	100	100	97.9	95.2	93.8	91.6
DEET	2	100	100	100	100	100	100
Untreated	20	0	2.2	3.1	4.8	4.9	5.5

Mean protection time based upon time to FCC.

Formulation	
Lotion (30% active ingredient)	Spray (40% active ingredient)
6hrs	5 hrs 15 min
4 hrs 45 min	6 hrs
6 hrs	6 hrs
6 hrs	6 hrs
6 hrs	6 hrs
6 hrs	3 hrs 45 min
6 hrs	6 hrs
6 hrs	6 hrs
6 hrs	6 hrs
6 hrs	5 hrs 30 min
3 hrs 30 min	3 hrs 30 min

DATA EVALUATION REPORT

STUDY TYPE:	Efficacy studies for Extract of Lemon Eucalyptus
MRID NO.:	446241-05
PROJECT ID	080598
SPONSOR:	Wisconsin Pharmacal Co., Inc.
TEST MATERIAL:	Oil of Lemon Eucalyptus
TESTING FACILITY:	Medical Advisory Services for Travelers Abroad, Ltd (MASTA), London School of Hygiene and Tropical Medicine, and Wisconsin Pharmacal Co. Inc.
AUTHORS:	R.J. Dillon, Chris Curtis, Jane K. Trigg, Paul Clarke, and Mary Wundrock
STUDY COMPLETED:	August 4, 1998

Study Summaries: This submission contained a compendium of studies, abstracts, etc. collected from the open technical literature.

Title: Preliminary Laboratory Tests of 50% concentration of extract of the lemon eucalyptus oil in ethanol: Conducted in London, by MASTA, 1993.

Summary:
Cage tests were conducted with *Anopheles stephensii*, *Aedes aegypti*, and sandflies to determine the efficacy of a 50% solution extract of lemon eucalyptus in ethanol. MASTA results indicated six to eight hours of efficacy.

However, the Natural Insect Repellent Lotion contains 30% Oil of Lemon Eucalyptus and the Natural Insect Repellent Pump Spray contains 40% Oil of Lemon Eucalyptus. Result of a test using 50% lemon of eucalyptus are not necessarily indicative of the Natural Insect Repellent products level of efficacy.

Title : Preliminary laboratory tests of repellent efficacy of cis and trans isomers of p-methane 3,8 diol (PMD) tested separately against hungry mosquitoes: Conducted in London, by MASTA, 1993.

Summary:
Cage tests were conducted with *Aedes aegypti* to determine the insect repellent properties of PMD isomers cis and trans. According to MASTA, 91.3% repellency was achieved for the cis isomer and 76.5% for the trans isomer after one hour.

This study does not demonstrate the level of efficacy of Natural Insect Repellent Lotion containing 30% Oil of Lemon Eucalyptus nor Natural Insect Repellent Pump Spray containing 40% Oil of Lemon Eucalyptus. Result of a test using PMD are not necessarily indicative of the Natural Insect Repellent products level of efficacy.

Title: Insect repellent trial with sandflies: Conducted by R.J. Dillon, April 23, 1993.

Summary:
Cage tests were conducted with sandflies (female *Phlebotomus papatas*) to determine the efficacy of a 50% a.i. repellent. Results indicated that this product worked for eight to twelve hours. Since the a.i. is not reported, it is assumed that it is lemon of eucalyptus. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Open air repellent test: Mosiguard Natural and Autan Spray (20% DEET): Conducted in Epping Forest, UK, by Dr. Chris Curtis, London School of Hygiene and Tropical Medicine. May 19, 1993.

Summary:
Field tests were conducted with *Aedes aegypti* to determine the efficacy of Mosi-guard (50% a.i.). Results showed that Mosi-guard demonstrated more than one hour of repellency. Since the a.i. is not reported, it is assumed that it is lemon of eucalyptus. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Report on repellency effects of Mosi-guard Natural against *Culex quinquefaciatus*: Conducted by the London School of Hygiene and Tropical Medicine, June 1993.

Summary:
Cage tests were conducted with *Culex quinquefaciatus* to determine the efficacy of Mosi-guard Natural spray (50% a.i.). Results showed that Mosi-guard demonstrated more than one hour of repellency. Since the a.i. is not reported, it is assumed that it is lemon of eucalyptus. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Brief assessment of Mosi-guard Natural spray formulation as compared to DEET spray formulation against blackfly (*Simulium woodi*): Conducted in Eastern Usambara Hills, Tanzania, Nov 27-29, 1993.

Summary:
Field tests were conducted with blackflies to determine the efficacy of Mosi-guard (50% a.i.) as compared to DEET. Results showed that Mosi-guard has limited repellency against the blackfly. Since the a.i. is not reported, it is assumed that it is lemon of eucalyptus. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy. But it can be inferred that if a product containing 50% a.i. is not efficacious, then a 30% or 40% formulation would also be lacking efficacy.

Title: A field assessment of the efficacy and longevity of Mosi-guard Natural mosquito repellent as compared with DEET: Conducted in Tanzania, by Jane K. Trigg, January, 1994.

Summary:
Field tests were conducted with mosquitoes (*Culex quinquefaciatus, Anopheles gambiae,* and *Anopheles funestus*) to determine the efficacy of Mosi-guard (50% a.i.) as a repellent. According to the results, Mosi-guard provided 6 to 7.75 hours of protection. Since the a.i. is not reported, it

is assumed that it is lemon of eucalyptus. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Insect repellent test report Mosi-guard Natural: Conducted at the London School of Hygiene and Tropical Medicine, March, 1994.

Summary:
Cage tests were conducted with *Anopheles gambiae* to determine the efficacy of 50% active ingredient formulations. Results indicated that PMD will remain efficacious for four hours. A 50% formulation of PMD may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Laboratory tests to assess efficacy of Mosi-guard Natural against Ticks: Conducted at Central Veterinary Laboratory, Addlestone, Surrey, England, by Jane K. Trigg, August, 1994.

Summary:
Cage tests were conducted with deer ticks, *Ixodes ricinis*, to determine the efficacy of Mosi-guard Natural spray (50% a.i.). Results from this test showed that Mosi-guard will decrease nymphal tick feeding and attachments. However, this test does not demonstrate that the Natural Insect Repellents will decrease tick bites and attachments. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Laboratory test to assess efficacy of Mosi-guard Natural against Triatomine Bugs: Conducted by Jane K. Trigg, August, 1994.

Summary:
Cage tests were conducted with *Rhodnius prolixus*to determine the efficacy of Mosi-guard (50% a.i.). Results demonstrated that Mosi-guard will not repel Triatomine bugs. Although the a.i.s are not identical, results suggest that the Natural Insect Repellent products will not repel Triatomine bugs.

Title: Laboratory and field trials to assess the efficacy and longevity of Mosi-guard Natural in protection against midge biting: Conducted at Purbright Laboratory, Woking, England and at Ormsary Estate', Argyllshire, Scotland, by Jane K. Trigg, Department of Medical Parisitology, London School of Hygiene and Tropical Medicine, July-August, 1994.

Summary:
Laboratory and field tests were conducted to evaluate the efficacy of Mosi-guard Natural spray (50% a.i.) against *Culicoides variipennis*. Results indicated that Mosi-guard Natural spray will remaining efficacious against biting midges for up to ten hours. However, this test does not demonstrate that the Natural Insect Repellents will repel midges. A 50% a.i. formulation may not be indicative of the Natural Insect Repellents level of efficacy.

Title: Determination of relative efficacy of a lemon eucalyptus based Natural Insect Repellent using *Aedes aegypti* in a cage test: Conducted at Jackson, WI, USA, by Wisconsin Pharmacal

Co., Inc., May-July 1998.

Summary:
Cage tests were conducted in the laboratory to determine the efficacy of three Natural Insect Repellent formulations (aerosol, non-aerosol pump, and lotion) against *Aedes aegypti*. Formulations including a range of concentrations (10% - 60%) of lemon of eucalyptus in alcohol were evaluated. Results indicated that test subjects received no bites with 30% and 40% lemon of eucalyptus. Fifty percent and 60% formulations repelled bites for up to six hours. It is, therefore, evident that results from a 50% formulation can not necessarily be bridged to a 30% or 40% formulation.

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Chemical:	Oil of eucalyptus Cyclohexanemethanol, 2-hydroxy-.alpha.,.alpha.,4-trimethyl-
	PC Code: 040503 011550
HED File Code:	41600 BPPD Other
Memo Date:	5/26/2000
File ID:	DPD264483
Accession #:	000-00-9001

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